Technical Appendices

Appendix H – Surface Water Hydrology and Water Quality

Schaaf & Wheeler. NEC Hwy. 101 & Cochrane Road – Hydrology Report. May 2005.

NEC Hwy. 101 & Cochrane Road

Hydrology Report

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1. SETTING

a. Existing Drainage

(1) Coyote Creek

The approximately 66-acre project site is located within the Coyote Creek watershed. Coyote Creek drains an approximately 420 square mile watershed, approximately half of which drains into Anderson Reservoir. Coyote Creek flows out of Anderson Reservoir and travels northwest to the San Francisco Bay. As shown on Figure 1, Coyote Creek is approximately one half mile east of the project site.

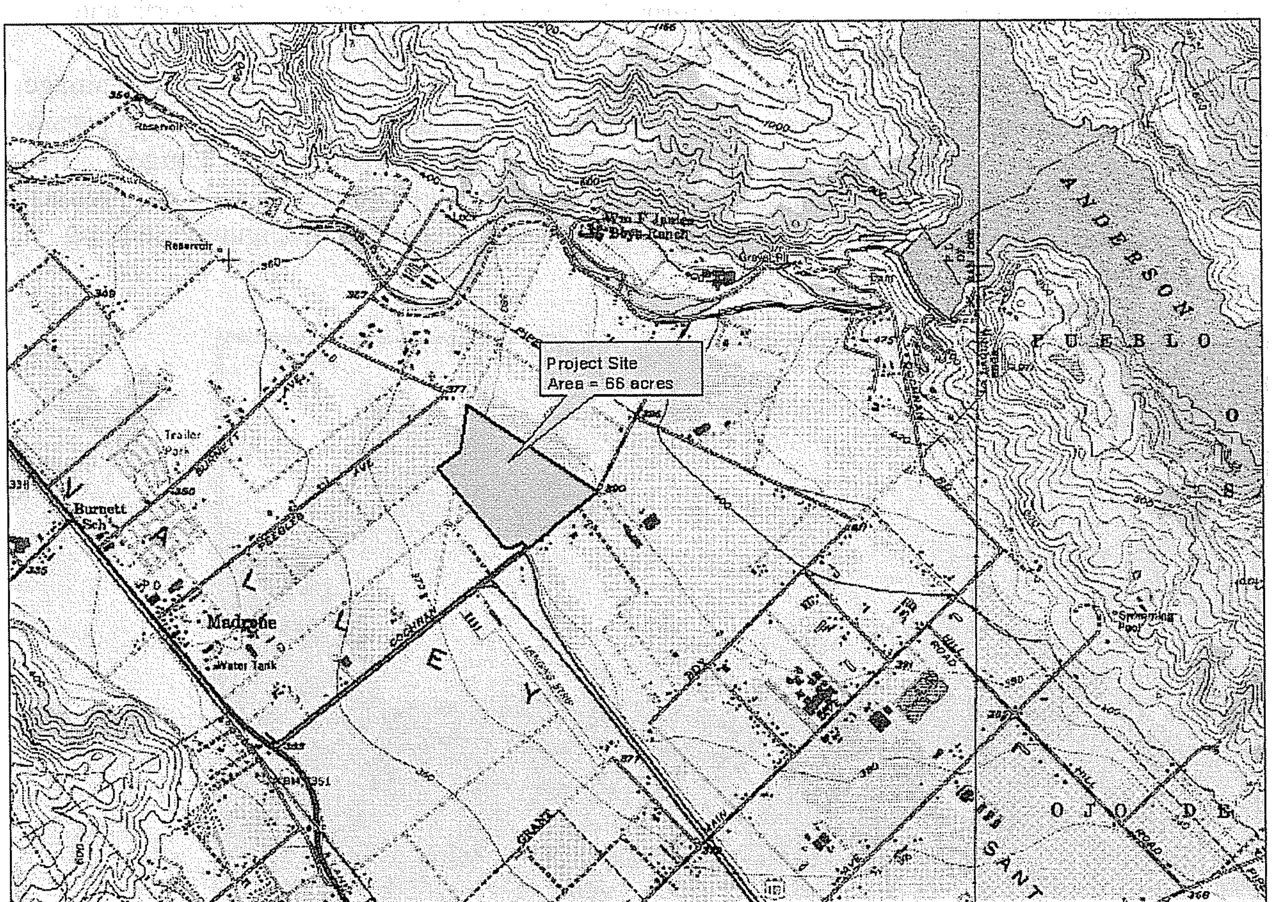

Figure 1 – Project Site Location Map

The Water Quality Control Plan (Basin Plan)[1] prepared by the San Francisco Bay Regional Water Quality Control Board (Regional Board, Region 2) defines the existing and potential beneficial uses of Coyote Creek, which must be protected from pollution and nuisance as a result of waste discharge, as: cold freshwater habitat, fish migration, preservation of rare and endangered species, contact and non-contact water recreation, fish spawning, warm freshwater habitat, and wildlife habitat. The current version of the Basin Plan can be found on the Regional

[1] San Francisco Bay Regional Water Quality Control Board. *San Francisco Bay Basin Plan – Chapter 2: Beneficial Uses*, Table 2-5, Basin 5 – Santa Clara Basin.

Board's website at http://www.waterboards.ca.gov/sanfranciscobay/basinplan.htm.

The 2002 Clean Water Act (CWA) 303(d) List of Water Quality Limited Segments[2] identifies Coyote Creek as not meeting applicable water quality standards for the pollutant Diazinon. Concentrations of Diazinon in Coyote Creek are higher in the South Bay primarily due to its use in agriculture. The Regional Board's current list of impaired water bodies can be found on their website at http://www.swrcb.ca.gov/tmdl/docs/2002reg2303dlist.pdf.

(2) Site Drainage

The project site contains no natural drainage channels or man made drainage facilities. All surface water leaving the site does so in the form of overland flow generally in the north and northwest direction. Stormwater runoff from the project site is minimal because of flat topography and the presence of B-type soils which are characterized as providing good drainage and moderate permeability. Precipitation from shorter duration and more frequent return period storms infiltrates into the permeable soils without generating appreciable runoff. Longer duration and less frequent storms generate enough precipitation to saturate the soils and produce on-site ponding and excess stormwater runoff. The project site is shown in Figure 2, looking south from the north end of the site.

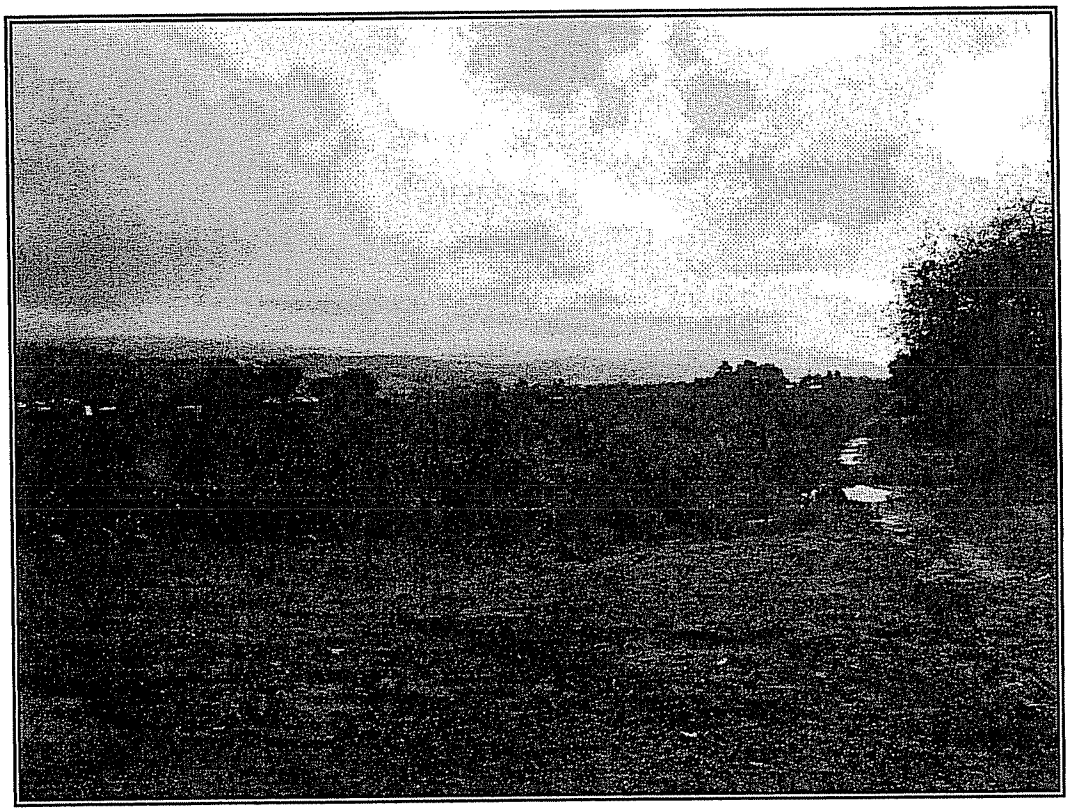

Figure 2 – Project Site

[2] San Francisco Bay Regional Water Quality Control Board. *2002 CWA Section 303(d) List of Water Quality Limited Segments*. Approved by USEPA: July 2003.

(3) Cochrane Channel

The Cochrane Channel is a Santa Clara Valley Water District (District) owned facility that starts at the southwestern corner of the project site at the intersection of Hwy. 101 and Cochrane Road and flows north to Coyote Creek between the project site and Hwy. 101. The approximately 8 foot deep trapezoidal channel has a 4 foot bottom width and 2:1 side slopes, with the bottom 3 feet lined with concrete. The channel was constructed as part of the Hwy. 101 extension project and was intended to intercept surface water runoff from the east as well as drainage from Hwy. 101 via multiple Caltrans storm drainage pump stations located along the length of the channel. The channel empties into Coyote Creek approximately 2,800 feet north of Burnett Ave. overpass at Hwy. 101. The Cochrane Channel is shown in Figure 3, looking north toward Coyote Creek.

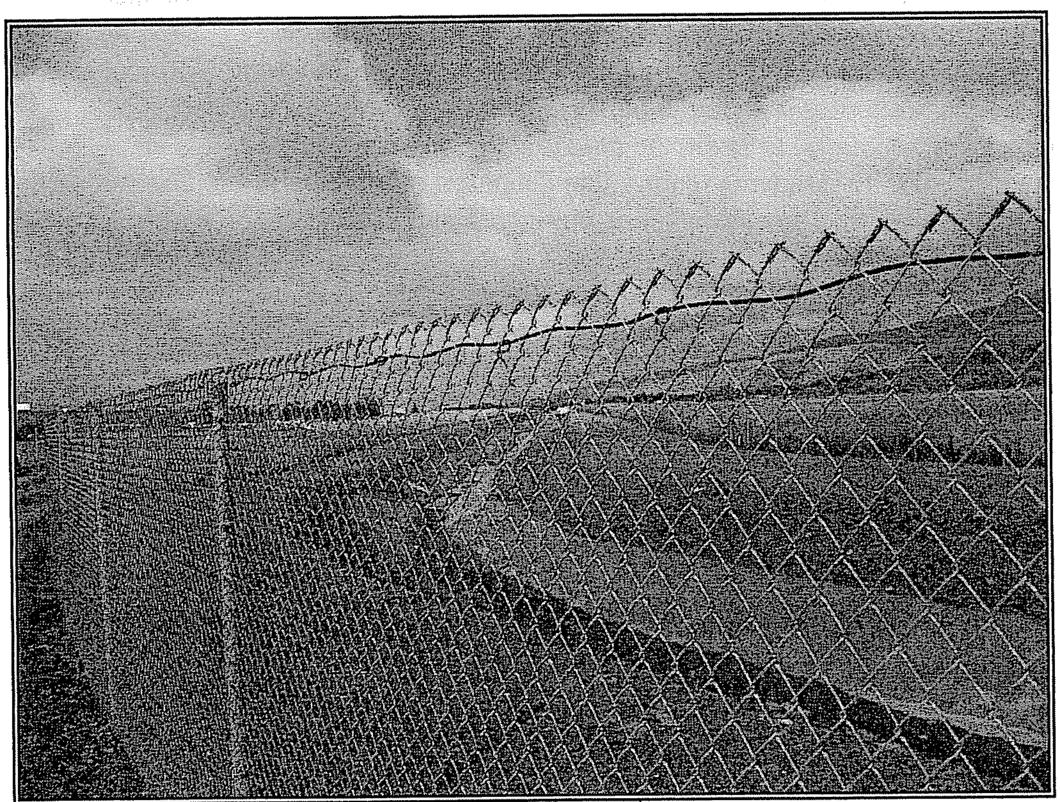

Figure 3 – Cochrane Channel (looking North toward Coyote Creek)

(4) Cross Valley Pipeline[3]

The District's 78-inch Cross Valley Pipeline is located adjacent to the Cochrane Channel and within an easement adjoining Cochrane Road. The pipe carries raw water from the Santa Clara Conduit to the Calero Pipeline at Calero Reservoir as part of the Central Valley Project (CVP), a project undertaken by the U.S. Bureau of Reclamation beginning in 1935 to bring water from the Sacramento River basin to the San Francisco Bay Area. Additional information about the Santa

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[3] Excerpted from the Drainage and Water Quality section of the Draft EIR prepared for the Morgan Hill Auto Mall/Retail Center dated July 1, 1993.

Clara Conduit, Calero Reservoir and Pipeline and the Central Valley Project can be found on the Santa Clara Valley Water District's website at http://www.valleywater.org.

b. Existing Storm Drainage System

The City's existing storm drainage system consists of curb and gutter facilities, curb inlets, and underground pipelines draining into creek, detention and retention ponds. Underground storm drainage pipes range from 12 to 60 inches in diameter, with most pipes being 18 inches in diameter.

In 1982, the City adopted subdivision design standards requiring new development to construct interim on-site detention or retention ponds to avoid increased runoff levels and associated exacerbation of downstream flooding. A *detention pond* is required when there is a municipal storm drain outlet available to receive storm runoff generated by development of a project site. Alternatively, projects on properties without an outlet to the existing drainage system are required to include *retention pond(s)* to avoid the potential for increased flood peaks on downstream areas. Current City standards require that detention ponds be sized to accommodate the 25-year, 24-hour storm and that retention ponds be sized for the 100-year, 24-hour storm.

A letter dated December 10, 2004 from the Santa Clara Valley Water District (Ms. Yvonne Arroyo) to the City of Morgan Hill (Ms. Rebecca Tolentino) confirms that the project site is located within the Cochrane Channel watershed and as such drainage from the site should be directed to the channel.

c. Flooding Hazards

(1) FEMA 100-Year Floodplain (Coyote Creek)

The effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Morgan Hill, California (Community-Panel Number: 060346-0003C, effective December 22, 1998) shows that the project site is located within a Special Flood Hazard Area (SFHA) designated as Zone X (shaded). The Zone X (shaded) designation identifies areas that are outside the 100-year floodplain, and areas subject to 100-year flooding with average depths less than one foot, areas subject to 100-year flooding where the drainage area is less than one (1) square mile, or areas protected from the 100-year flood by levees.

(2) Dam Failure Inundation Area (Anderson Reservoir)

Anderson Reservoir is retained by an earth and rock dam built in 1950. Owned and operated by the District, the reservoir is located approximately one mile east of the project site. The 1,271 acre reservoir has a storage capacity is 90,373 acre-feet. The entire project site is located within the dam failure inundation area resulting from the catastrophic failure of Anderson Reservoir. Areas affected by such catastrophes have been mapped by the District. The current version of the *Hazard Map* showing the inundation area is available from the Association of Bay Area Governments (ABAG) website at http://www.abag.ca.gov and is generalized from the map prepared by the Santa Clara Valley Water District for studies completed for the Federal Energy

Regulatory Commission (FERC) and the California State Department of Water Resources, Division of Safety of Dams (DSOD)and on file with the State Office of Emergency Services. The *Hazard Maps* are subject to the following caveats:

- The maps were developed by dam owners to fulfill state law requirements and are intended for emergency planning purposes;
- The maps were developed using engineering hydrology principles and represent the **best estimate** of where the water would flow if the dam completely failed with a full reservoir. The inundation area is based completely emptying the reservoir and does not include runoff from storms; and,
- Many of the maps were developed in the 1970's. Had the maps been developed more recently, different assumptions and map-making methods would have been used.

According to the Health and Safety element of the Santa Clara County General Plan[4], "*...dam failure may occur suddenly, such as in the event of major earthquake, releasing thousands of acre-feet of water with the force to create major life and property losses in the area immediately downstream from the dam. Flooding can also occur due to overtopping of the dam structure during periods of intense precipitation.*" A separate discussion of dam failure inundation contained in the County's General Plan goes on to say "*...strengthening and modifications to dams and spillways that will ensure the structural safety of the reservoirs in Santa Clara County is an ongoing effort of the Water District.*" The County General Plan can be found on their website at http://www.sccgov.org.

2. IMPACTS

a. Site Drainage

Development of the project site would result in an increase in storm water runoff volumes from the site because the project site is currently undeveloped, consisting largely of bare soils. The discharge from the site is a function of the rainfall intensity, the runoff coefficients and the tributary drainage area. In the pre- and post- development conditions, the rainfall intensity and tributary drainage area will be the same. The variable will therefore be the runoff coefficients, which are dependent upon the amount of impervious surfaces. Increases in the amount of impervious surfaces result in loss of permeable surfaces available for infiltration of rainfall falling on the project site.

The project may be required to comply with Provision C.3 of the Santa Clara Valley Urban Runoff Pollution Prevention Program's (SCVURPPP) NPDES Permit for stormwater discharges to South San Francisco Bay and its tributaries. The SCVURPPP is an association of thirteen cities and towns in the Santa Clara Valley, together with Santa Clara County and the Santa Clara Valley Water District. Program participants share a common NPDES permit issued by the San Francisco Bay Regional Water Quality Control Board (Region 2) to discharge stormwater to South San Francisco Bay and its tributaries.

[4] County of Santa Clara, Planning Office. *Santa Clara County General Plan.* Adopted: December 20, 1994.

The City of Morgan Hill is not a member of the SCVURPPP. In addition, the City's NPDES permit is issued by the Central Coast Region (Region 3). Although the City of Morgan Hill is not a member of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), the project will be discharging stormwater to South San Francisco Bay and its tributaries and will require a permit to outfall to a Santa Clara Valley Water District facility; therefore the project may be held to the C.3 Provisions contained in the NPDES discharge permit issued by Region 2 to the 13 SCVURPPP participants.

Under Provision C.3, post-development peak stormwater runoff discharge rates and durations cannot exceed pre-development rates and durations if the increased peak stormwater discharge rates and/or durations would result in increased potential for erosion or other adverse impacts to designated beneficial uses. However, this requirement does not apply to projects that discharge stormwater runoff into creeks or storm drains where the potential for erosion is minimal, including discharges to creeks that are concrete-lined or significantly hardened to their outfall in San Francisco Bay, as well as construction of infill projects in highly developed watersheds.

Based on these criteria, no additional reduction in stormwater runoff volumes would be required because the project is discharging to the concrete-lined Cochrane Channel and because the potential for increased erosion in Coyote Creek is considered minimal because of the large size of its watershed and because the low-flow discharges are controlled by releases from Anderson Reservoir.

(1) Existing Discharge Rate

Per City design standards, the Rational Method shall be used to determine the quantity of stormwater runoff from a project site. The County manual also recommends use of the Rational Method to provide reasonable estimates of peak discharge for drainage areas less than 200 acres. The Rational Method relates peak discharge (Q) to rainfall intensity (i) by:project site. The exact volume of flood water to be retained during the design storm conditions will be finalized during final design of the project, in concert with the landscape architect. Further increases in t

$$Q = CiA$$

Where:

Q	=	peak discharge, cfs
C	=	runoff coefficient, dimensionless
i	=	rainfall intensity, in/hr[5]
A	=	drainage area, acres

Runoff Coefficient, C

City standards suggest a runoff coefficient, C-value, of 0.1 for "parks and natural ground." The County manual suggests a C-value of 0.15 for B-type soils and "agricultural" land use, a

[5] Assumes that storm duration is equal to the time of concentration (t_c) for the drainage basin.

description more suitable for the existing land use condition; therefore, a C-value of 0.15 was used to estimate the existing condition runoff.

Time of Concentration, t_c

Site topography obtained from Kier & Wright was used to estimate the maximum length of overland flow from the most remote point in the watershed to the basin outlet as well as the slope of the land, primarily in a northwesterly direction. The Kirpich formula was used to estimate the time of concentration for the overland flow across the site. The formula is given by:

$$t_c = 0.0078\,(L^2/S)^{0.385} + 10$$

Where:

t_c	=	time of concentration, minutes
L	=	maximum length of travel from headwater to outlet, feet
S	=	effective slope, ft/ft

Based on the site topography, the maximum length of overland flow is estimated to be 2500 feet and the effective slope is approximately 0.004 ft/ft, resulting in a time of concentration of approximately 36 minutes (0.6 hours).

Rainfall Intensity, i

Rainfall intensities for various storm durations and return intervals were obtained using the District's Return Period-Duration Specific (TDS) Regional Equation contained in the District's *Hydrology Procedures* and the County manual. This equation was developed to establish a relationship between precipitation depth and Mean Annual Precipitation (MAP) for various return period storms and is given by:

$$X_{T,D} = A_{T,D} + (B_{T,D} * MAP)$$

Where:

$X_{T,D}$	=	precipitation depth for a specific return period and duration, inches
T	=	return period, years
D	=	storm duration, hours
$A_{T,D}$	=	coefficient from District and County manuals, dimensionless
$B_{T,D}$	=	coefficient from District and County manuals, dimensionless
MAP	=	mean annual precipitation, inches

The precipitation intensity, $i_{T,D}$, is given by:

$$i_{T,D} = x_{T,D}/D$$

The Mean Annual Precipitation (MAP) at the project site is roughly 20 inches as excerpted from the District's *Mean Annual Precipitation Map, San Francisco and Monterey Bay Region.* Additionally, values for $A_{T,D}$ and $B_{T,D}$ were excerpted from tables contained in the District's

Hydrology Procedures. The District's tables only contained values for these variables corresponding to storm durations of 0.5 and 1.0 hours; therefore, the values for a storm duration of 0.6 hours (see Time of Concentration above) were interpolated from the values contained in the tables. The values for the 2-, 10-, 25-, 100-year return period storms excerpted from the District's tables and used in the precipitation depth and intensity calculations are shown in Table 1 below:

Table 1 - Precipitation Depth and Intensity Coefficients

Storm Duration (hours)	Return Period							
	2-Year		10-Year		25-Year		100-Year	
	$A_{T.D}$	$B_{T.D}$	$A_{T.D}$	$B_{T.D}$	$A_{T.D}$	$B_{T.D}$	$A_{T.D}$	$B_{T.D}$
0.6	0.220775	.006918	0.379833	0.009264	0.456767	0.010311	0.568469	0.011726

The calculated values for the precipitation depth and intensity, as well as the stormwater runoff calculated using the Rational Method equation are shown for the 2-, 10-, 25-, 100-year return period storms in Table 2 below:

Table 2 - Precipitation Depth and Intensity Calculations

Storm Duration (hours)	2-Year		10-Year		25-Year		100-Year	
	$x_{T.D}$ (in)	$i_{T.D}$ (in/hr)	$x_{T.D}$ (in)	$i_{T.D}$ (in/hr)	$x_{T.D}$ (in)	$i_{T.D}$ (in/hr)	$x_{T.D}$ (in)	$i_{T.D}$ (in/hr)
0.6	0.359	0.598	0.565	0.942	0.663	1.105	0.803	1.338

Existing Condition Discharge Rate, Q

The results of the Rational Method calculations for the existing condition are shown on Table 3 below:

Table 3 - Rational Method Parameters & Existing Condition Discharge

C	A (acres)	2-Year		10-Year		25-Year		100-Year	
		$i_{T.D}$ (in/hr)	Q (cfs)	$i_{T.D}$ (in/hr)	Q (cfs)	$i_{T.D}$ (in/hr)	Q (cfs)	$i_{T.D}$ (in/hr)	Q (cfs)
0.15	66	0.598	5.9	0.942	9.3	1.105	10.9	1.338	13.2

Based on the calculations performed using the District's TDS equations and the Rational Method, the 2-, 10-, 25- and 100-year discharges from the project site for the existing condition are estimated to be 5.9 cfs, 9.3 cfs, 10.9 cfs and 13.2 cfs, respectively.

(2) Project Discharge Rate

The same procedures were used to calculate the project condition stormwater runoff from the project site as were used to calculate the existing condition; however, several of the values used in the Rational Method formula were changed to reflect the developed condition.

Runoff Coefficient, C

City standards suggest a runoff coefficient, C-value, of 0.8 for "commercial" land use. The County manual suggests the same value be used; therefore, a C-value of 0.80 was used to estimate the project condition runoff.

Time of Concentration, t_c

The time of concentration for the project condition is the sum of the roof-to-gutter time and the pipe flow time. The roof-to-gutter time is an estimate of the amount of time for runoff to collect on impervious surface such as rooftops or parking lots and make its way across the roofs or parking lots, through roof gutters and downspouts or parking lot catch basins and into the underground storm drain pipe system. This value is assumed to be 10 minutes per the County manual.

The pipe flow time is calculated by dividing the distance that flow must travel in the pipe system from the most upstream catch basin to the outlet point by the average flow velocity in the pipe, assumed to be approximately 4 feet per second. Site topography obtained from Kier & Wright, along with a proposed site layout schematic obtained from the project owner was used to estimate the probable layout of the storm drain system and to approximate the length of storm drain pipe necessary to connect the most upstream storm drain inlet to the probable location of one or more stormwater detention ponds assumed to be located at the northern end of the project site. Using an estimated pipe length of 2,500 feet and an assumed velocity of 4 feet per second results in a pipe flow time of about 10 minutes. Combined with the roof-to-gutter of 10 minutes, the approximate time of concentration for the project condition is equal to 20 minutes (0.33 hours).

Rainfall Intensity, i

The decrease in the time of concentration from the existing condition to the project condition results in an increase in the rainfall intensity used in the Rational Method calculations; therefore, rainfall intensities corresponding to the shorter time of concentration are required. The District's tables only contained values for these variables corresponding to storm durations of 0.5 and 1.0 hours; therefore, the values for a storm duration of 0.33 hours (see Time of Concentration above) were interpolated from the values contained in the tables. The values for the 2-, 10-, 25-, 100-year return period storms excerpted from the District's tables and used in the precipitation depth and intensity calculations are shown in Table 4 below:

Table 4 - Precipitation Depth and Intensity Coefficients

Storm Duration (hours)	Return Period							
	2-Year		10-Year		25-Year		100-Year	
	$A_{T,D}$	$B_{T,D}$	$A_{T,D}$	$B_{T,D}$	$A_{T,D}$	$B_{T,D}$	$A_{T,D}$	$B_{T,D}$
0.33	0.188578	0.004104	0.319159	.005766	0.379934	0.006636	0.465551	0.007924

The calculated values for the precipitation depth and intensity, as well as the stormwater runoff calculated using the Rational Method equation are shown for the 2-, 10-, 25-, 100-year return period storms in Table 5 below:

Table 5 - Precipitation Depth and Intensity Calculations

Storm Duration (hours)	2-Year		10-Year		25-Year		100-Year	
	$x_{T,D}$ (in)	$i_{T,D}$ (in/hr)	$x_{T,D}$ (in)	$i_{T,D}$ (in/hr)	$x_{T,D}$ (in)	$i_{T,D}$ (in/hr)	$x_{T,D}$ (in)	$i_{T,D}$ (in/hr)
0.33	0.271	0.820	0.434	1.317	0.513	1.553	0.624	1.891

Project Condition Discharge Rate, Q

The results of the Rational Method calculations for the project condition are shown on Table 6 below:

Table 6 - Rational Method Parameters & Existing Condition Discharge

C	A (acres)	2-Year		10-Year		25-Year		100-Year	
		$i_{T,D}$ (in/hr)	Q (cfs)	$i_{T,D}$ (in/hr)	Q (cfs)	$i_{T,D}$ (in/hr)	Q (cfs)	$i_{T,D}$ (in/hr)	Q (cfs)
0.8	66	0.820	43.3	1.317	69.5	1.553	82.0	1.891	99.8

Based on the calculations performed using the District's TDS equations and the Rational Method, the 2-, 10-, 25- and 100-year discharges from the project site for the project condition are estimated to be 43.3 cfs, 69.5 cfs, 82.0 cfs and 99.8 cfs, respectively. The project condition discharges are significantly greater than the existing condition discharges primarily due to the increase in impervious coverage and subsequent loss of on-site infiltration and the decrease in the time of concentration for the 66 acre drainage area represented by the project site. ***These increases constitute a significant adverse impact that can be mitigated*** (see Section 3, Mitigations, beginning on page 13 of this report).

<u>b. Proposed Storm Drainage Improvements</u>

(1) Underground Pipe System

An underground pipe system will be required to pick up the stormwater runoff from the buildings and parking lots at multiple catch basins to be located in the parking lot area(s) and convey the runoff to one or more stormwater detention ponds proposed to be located at the northern end of the project site. The size of the storm drain pipes will be dependent on the slope and tributary area for the subject reach of pipe. The underground pipe system, including catch basins shall make every possible effort to integrate stormwater quality best management practices as discussed in Section 3, Mitigation. In addition, City standards, including pipe material, pipe size, maximum slopes, minimum flow velocities, etc. shall be adhered to in designing the on-site storm drainage system.

(2) Detention Facilities

The City of Morgan Hill requires that stormwater detention be included in the project to mitigate the increase in stormwater runoff from the project site. The City's detention criteria, as well as the sizing of detention facilities for the project are discussed in Section 3, *Mitigation.*

The City of Morgan Hill requires that detention facilities be equipped with a reasonable outlet to drain them. The Water District requires that the detention pond(s) maintain the post-development discharges to the Cochrane Channel at or below predevelopment levels for the 2-, 10-, and 100-year return period storms (see letter dated December 9, 2004 from Yvonne Arroyo, Santa Clara Valley Water District, to Christopher Eggers, Schaaf & Wheeler). The City and Water District detention pond sizing and allowable discharge criteria are further discussed in Section 3, *Mitigation.*

c. <u>Local Flooding Impacts</u>

(1) Coyote Creek Flooding

The project site is located within a Special Flood Hazard Area (SFHA) designated as Zone X (shaded) by the Federal Emergency Management Agency (FEMA)[6]. The Zone X (shaded) designation identifies areas that are outside the 100-year floodplain, and areas subject to 100-year flooding with average depths less than one foot, areas subject to 100-year flooding where the drainage area is less than one (1) square mile, or areas protected from the 100-year flood by levees. The decision of whether to require flood insurance for properties located within Zone X (shaded) designated areas is left to the individual lenders; however, to minimize the risk of flood damage to properties and to demonstrate to lenders that efforts have been made to reduce such risk, finished floor elevations should be raised a minimum of 1 foot above existing grade.

(2) Anderson Reservoir

The entire project site is located within the dam failure inundation area resulting from the failure of Anderson Reservoir; therefore, the development of the proposed project would create additional exposure to dam failure risk and the associated potential loss of life and property. As stated in the County General Plan, the Water District maintains on-going efforts to strengthen and modify dams and spillways to ensure the structural safety of reservoirs in Santa Clara County. The Water District's design goals are to design or retrofit their dams to withstand seismic events up to an 8.5 magnitude earthquake. Mr. Richard Volpe at the Water District confirmed that studies completed for the Federal Energy Regulatory Commission (FERC) and the California State Department of Water Resources, Division of Safety of Dams (DSOD) have predicted that Anderson Reservoir is capable of withstanding 7.25 and 8.25 magnitude earthquakes occurring on the Calaveras Fault and San Andreas Fault, respectively. The difference in the level of protection is based on the physical distance that the dam is located from the identified fault lines. Mr. Volpe indicated that the Water District is satisfied that the level of safety required to meet the requirements of both FERC and DSOD meets the District's desire to

[6] Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM), Morgan Hill, California, Community-Panel Number: 060346-0003C, effective December 22, 1998.

ensure the structural safety of reservoirs in Santa Clara County. ***The District's confidence in the safety of Anderson Reservoir as supported by their studies, combined with the probability of catastrophic dam failure being small, is sufficient to characterize the additional exposure as less-than-significant.*** It should be noted that the EIR prepared for the County General Plan also characterized the impact from dam failure to be less-than-significant based on its low probability of occurrence.

d. Water Quality

(1) Construction and Post-Construction Impacts

Urban contaminants in runoff from the project site could lower the quality of stormwater runoff and infiltrating groundwater both during and after construction. Erosion and sedimentation are major visible water quality impacts attributable to construction activities. Sediment impact on water quality includes interference with photosynthesis, oxygen exchange, and respiration, growth, and reproduction or aquatic species. Other pollutants such as nutrients, trace metals, and hydrocarbons can attach to sediment and be transported by it. Development of the project site would include construction activities, such as excavation and trenching for foundations and utilities, grubbing and clearing, soil compaction and moving, cut and fill activities, and grading that would disturb soil and could decrease permeability. Unprotected disturbed soil is susceptible to high rates of erosion from wind and rain, resulting in sediment transport from the site. Increased runoff from the site resulting from decreased permeability both during and after construction would further exacerbate the amount of sediment transport. Sediment-laden runoff resulting from construction and post-construction operations at the site could enter the Cochrane Channel and Coyote Creek and degrade water quality.

Delivery, handling and storage of construction materials and wastes; as well as use of construction equipment onsite during the construction phase of the project also introduce a risk for stormwater contamination which could impact water quality. Spills or leaks from heavy equipment and machinery can result in oil and grease contamination of stormwater. Some hydrocarbon compound pollution associated with oil and grease can be toxic to aquatic organisms at low concentrations. Staging areas, or building sites can be the source of pollution due to paints, solvents, cleaning agents, and metals contained in the surface of equipment and materials. The impacts associated with metal pollution of stormwater include toxicity to aquatic organisms, bioaccumulation of metals in aquatic animals, and potential contamination of drinking supplies. Pesticide use (including herbicides, fungicides, and rodenticides) associated with site preparation work is another potential source of stormwater contamination. Pesticide impact to water quality includes toxicity to aquatic species and bioaccumulation in larger species through the food chain. Gross pollutants such as trash, debris, and organic matter are additional potential pollutants associated with the construction phase of the project. Impacts include health hazards and aquatic ecosystem damage associated with bacteria, viruses and vectors which can be harbored by gross pollutants.

In the post construction phase of the project, the major source of pollution to runoff and infiltrating groundwater will be contaminants which have accumulated on the land surface over which storm water passes. In developed areas, driveways, parking lots, sidewalks, streets and gutters are often connected directly to storm drains that collect and guide stormwater runoff. Between rainstorms materials are deposited on these surfaces from debris dropped or scattered by individuals, street sweepings, debris and other particulate matter washed into roadways from adjacent areas, wastes and dirt from construction and renovation or demolition, fecal droppings from animals, remnants of household refuse dropped during collection or scattered by animals or wind, oil and various residues contributed by automobiles, and fallout of air-borne particles. Pollutants associated with the post construction phase of the project include nutrients, oil and grease, metals, organics, pesticides, and gross pollutants. Nutrients which may be contributed to stormwater in the post construction phase include nitrogen and phosphorous resulting from fertilizers applied to landscaping in the project area. Excess nutrients can impact water quality by promoting excessive and/or rapid growth of aquatic vegetation; reducing water clarity, and resulting in oxygen depletion. Pesticides also may enter into stormwater after application on landscaping areas of the project. Pesticides impact on water quality because they are toxic to aquatic organisms and can bioaccumulate in larger species such as birds and fish. Oil and grease may be contributed to stormwater in the post construction phase of the project from automobile leaks, car washing, restaurants, and waste oil disposal. Metals may enter stormwater in the post construction phase of the project as surfaces corrode, decay or leach. Potential gross pollutants associated with the post construction phase include clippings from with landscape maintenance, street litter, and animal excrement. Impacts due to oil and grease, metal contamination, and gross pollutants are discussed as part of construction phase impacts above.

During rainfall, a film of water builds up on impermeable surfaces. Once this film is of sufficient depth (about 0.1 inch), the water collecting on the impermeable surface begins to flow. The initial flow of each storm often contains the highest concentrations of pollutants, but this is not always the case because the phenomenon is dependent on the duration of the preceding dry weather period, rainfall patterns, rainfall intensity, the chemistry of individual pollutants, and other site-specific conditions.

If uncontrolled, the accumulation of urban pollutants could have a detrimental cumulative effect during both the construction and post construction phases of the project because overland flow from paved surfaces and landscaped areas transport many of the above-mentioned constituents, thereby contributing to the deterioration of the quality of stormwater runoff and infiltrating groundwater. The cumulative result could be the incremental deterioration of water quality in the Cochrane Channel, Coyote Creek and the San Francisco Bay.

(2) Channel Erosion

Increased stormwater runoff from the project site is proposed to be mitigated through the construction of one or more detention ponds that will maintain stormwater runoff at or below the existing 10-year discharge rate of 9.3 cfs; however, discharges up to this threshold value to the Cochrane Channel and ultimately to Coyote Creek will occur more frequently and for longer durations that they would without the development of the project. These more frequent and longer duration releases have the potential to increase erosion in Coyote Creek, particularly because they exceed the "channel forming" flow, typically defined as the 2-year flow or less. However, the 2-year and more frequent return period discharges in Coyote Creek are controlled by releases from Anderson Reservoir which is owned and operated by the District. Erosion would not be an issue for the Cochrane Channel as the bottom 3 feet of the channel is lined with concrete. Furthermore, operational changes in the way Anderson Reservoir is regulated could easily increase the magnitude and duration of the 2-year flow in Coyote Creek regardless of the release rate from the project site; therefore, the potential impact to erosion in Coyote Creek from the project site is considered to be negligible.

3. MITIGATIONS

a. Storm Drainage Impacts of Project Development

(1) Detention Facilities

Detention Ponds

City of Morgan Hill Storm Drainage Design Standards require that detention basins on private property be designed using a 24-hour, 25-year storm with a total rainfall depth of 4.79 inches if a reasonable outlet is provided. In addition, the City requires that 25% of the total basin volume be available for freeboard and that fencing be provided around all basins greater than 3 feet in depth.

A depth of 4.79 inches of rainfall spread over 66 acres and multiplied by 0.65 (the difference between the existing condition runoff coefficient (C=0.15) and the project condition runoff coefficient (C=0.8)) equates to approximately 17.1 acre-feet, representing the minimum size of detention storage required by the City to mitigate for increased stormwater runoff from the project site. An additional 4.3 acre-feet is required for freeboard, bringing the total volume required for detention to 21.4 acre-feet.

Construction of a single, or multiple detention ponds with a volume of 21.4 acre feet would meet the City standards and would reduce the impact of increased stormwater runoff from the project site to a less than significant level.

The proposed site plan includes two triangular shaped detention ponds to be located at the northern end of the project site. The larger pond, located at the northeast corner of the project site has a surface area of approximately 78,508 square feet (1.80 acres) and is proposed to be 13 feet deep with 2:1 (H:V) turfed sideslopes. The total volume of the larger pond is approximately 18.1 acre-feet.

The smaller pond, located at the northeast corner of the project site has a surface area of approximately 22,935 square feet (0.53 acres) and is proposed to be 13 feet deep with 2:1 (H:V) turfed sideslopes. The total volume of the smaller pond is approximately 3.9 acre-feet. The total volume provided by both ponds is approximately 22.0 acre-feet. Table 7 provides a breakdown of the amount of storage provided by the large pond, small pond, and the two ponds combined at 1.0 foot depth increments.

Table 7 - Detention Pond Stage-Storage Relationship

Pond Stage (ft)	Large Pond Volume (ac-ft)	Small Pond Volume (ac-ft)	Combined Pond Volume (ac-ft)
0	0	0	0
1	1.0	0.1	1.2
2	2.1	0.3	2.4
3	3.3	0.5	3.8
4	4.5	0.7	5.2
5	5.8	0.9	6.7
6	7.1	1.2	8.2
7	8.5	1.4	9.9
8	9.9	1.8	11.7
9	11.4	2.1	13.5
10	13.0	2.5	15.5
11	14.6	2.9	17.6
12	16.3	3.4	19.7
13	18.1	3.9	22.0

Outlet Structure(s)

The City of Morgan Hill requires that detention facilities be equipped with a reasonable outlet to drain them. The Water District requires that the detention pond(s) maintain the post-development discharges to the Cochrane Channel at or below predevelopment levels for the 2-, 10-, and 100-year return period storms (see letter dated December 9, 2004 from Yvonne Arroyo, Santa Clara Valley Water District, to Christopher Eggers, Schaaf & Wheeler).

The stormwater detention ponds will drain to the Cochrane Channel via a stormwater pump station consisting of multiple pumps designed to switch on and off at different pond stages to maintain post-development discharges for the 2-, 10- and 100-year return period storms at or below predevelopment levels shown on Table 3 in Section 2, *Impacts*. There is no minimum requirement for the amount of time that stormwater needs to be held in the ponds.

Per City standards, the detention ponds have been designed for the 25-year storm event; however, an additional 25% of detention volume is required for freeboard. This additional 25% for freeboard will provide increased storage for larger storm events such as the 50-year and 100-year return period storms. In addition, the outlet facility shall incorporate an emergency release to direct overtopping flows toward the west directly into the Cochrane Channel. Finally, the parking lots shall be graded to provide additional detention storage within the parking lot for events greater than the 25-year event. For design purposes, the grading shall allow a maximum of one foot of ponding within the parking lot before releasing toward the north and northwest in the direction that the site currently drains.

b. Flooding Impacts

The potential public safety threat associated with the failure of Anderson Reservoir (see Section 1.c, Flooding Hazards) is less-than-significant; however, in the interest of public safety, an emergency evacuation plan should be developed for the proposed development and its tenants. The plan's procedures should be developed jointly with the project owner, City public safety staff, and potential tenants to identify appropriate emergency response procedures and to ensure the efficient and safe evacuation of employees and customers in the unlikely event of dam failure and subsequent flooding. The emergency evacuation plan would also be beneficial in minimizing the impact from minor structural damage resulting from a major event (such as an earthquake) that would allow for sufficient time for evacuation from the project site.

The potential risk of damage to property associated with flooding of depths less than one foot (see Section 1.c, Flooding Hazards) could be reduced to a less than significant level by setting finished floor elevations for properties located within the project site a minimum of 1 foot above existing grade.

c. Water Quality

The project is required by California law to comply with the State General Construction Activity Stormwater Permit (NPDES requirement) because the project would disturb more than one acre of land. If any element of the project were developed in increments of less than one acre, permit compliance still would be required because the construction activity would be part of the larger plan of development.

Compliance with the permit involves filing a Notice of Intent (NOI) with Region 3 and preparing a Surface Water Pollution Prevention Plan (SWPPP) prior to construction activities. The SWPPP is required to identify the sources of sediment and other pollutants on-site, and to ensure the reduction of sediment and other pollutants in stormwater discharged from the site. A monitoring program is required to aid the implementation of, and assure compliance with, the SWPPP. The Region 3 permit requirements must be satisfied prior to project construction (see also the discussion below under the title Streamflow and Erosion). As part of the SWPPP, an Erosion and Sedimentation Control Plan must be prepared for the project prior to grading. Implementation of the SWPPP, as required by California law to comply with construction management procedures stipulated in Region 3's General Construction Activity Stormwater Permit, the City's General Plan, Municipal Code, and Urban Runoff Management Plan, and related policies adopted by the City and County, would ensure potential water quality effects associated with the project implementation would be less than significant.

Adherence to and implementation of the following minimum requirements, including site planning, construction, and post construction Best Management Practices (BMPs) and construction of one or more water quality ponds would mitigate the potential water quality impacts associated with the project development to less than significant levels:

(1) Site Planning

Pollutant transport into the storm drain system and ultimately into receiving waters shall be mitigated through the construction of retention/detention ponds at the northern end of the project site to infiltrate stormwater into the soil or temporarily store post-development runoff and release it to receiving waters at predevelopment flow rates. Additional site planning BMPs, equal or equivalent to those listed in the Bay Area Stormwater Management Agency's (BASMA) Design Guidance Manual, shall be incorporated into the project, to the maximum extent practicable, to improve the quality of stormwater before it reaches the storm drainage system and/or reduce stormwater runoff volumes from the project site.

(2) Construction BMPs

Construction BMPs that shall be implemented include measures to prevent and control erosion and sedimentation; source control of pollution from construction site materials, chemicals, and waste; control and treatment of runoff from any graded or otherwise disturbed areas; limiting of construction access roads; and monitoring and maintaining BMPs. Specific minimum construction phase BMPs to be incorporated in the project shall be included in the SWPPP prepared for the project.

(3) Post-Construction BMPs

Post construction operation of the project will include long-term BMPs to ensure continued mitigation of potential impacts to water quality resulting from the project. Post construction BMPs will address prevention and control of erosion and sedimentation, source control of potential pollutants, control and treatment of runoff, and protection of water quality resources. Minimum post construction BMPs that will be incorporated in the project are listed below:

1. Construction of stormwater detention/retention ponds at the northern end of the project site;

2. Impervious surfaces such as roads, parking lots, and driveways shall be routinely cleaned during both the "wet" and "dry" seasons to limit the accumulation of "first flush" contaminants. If the City does not agree to accept responsibility for street sweeping, the developer will arrange for this service within the project area for developed portions of the project;

3. If practicable, utilization of natural features such as grassy swales to capture pollutants before the stormwater runoff enters the storm drainage system;

4. If practicable, utilization of engineered products, such as storm drain inlet filters, oil/water separators, etc., to capture pollutants before the stormwater runoff enters the storm drainage system;

5. The developer shall distribute educational materials to the first tenants of properties included in the project development. These materials shall address good housekeeping

practices relating to stormwater quality, prohibited discharges, and proper disposal of hazardous materials;

6. The party responsible for any common landscaped areas shall implement a program of efficient irrigation and proper maintenance including minimizing use of fertilizer, herbicides and pesticides. This practice will mitigate impacts from nutrients and pesticides;

7. The tenants shall implement a trash management and litter control program to mitigate the impacts of gross pollutants on storm water quality. This program shall include litter patrol, emptying trash receptacles in common areas, and reporting and investigating and trash disposal violations;

8. Storm drain inlets shall be labeled with the phrase "No dumping – flows to Bay", or a similar phrase to mitigate the impact of potential for discharges of pollutants to the storm drain system; and,

9. Restaurants incorporated in the development will be designed with contained areas for cleaning mats, containers and sinks connected to the sanitary sewers. Grease shall be collected and stored in a contained area and will be removed regularly by a disposal recycling service. To this end, sinks shall be equipped with grease traps to provide for its collection. This BMP will mitigate potential impacts due to oil and grease.

There are no City requirements for a Planned Unit Development (PUD) to submit an Erosion Control Plan to obtain a grading permit. This requirement applies only to Residential Planned Developments (RPDs).

(4) Water Quality Pond(s)

Although the City of Morgan Hill is not a member of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), the project will be discharging stormwater to South San Francisco Bay and its tributaries and will require a permit to outfall to a Santa Clara Valley Water District facility; therefore the project may be held to the C.3 Provisions contained in the NPDES discharge permit issued by Region 2 to the 13 SCVURPPP participants.

In 2001, Region 2 re-issued WDRs under the NPDES program for the discharge of stormwater runoff (NPDES Permit No. CAS0299718, Regional Board Order No. 01-024), through the implementation of a Storm Water Management Plan (SWMP), which describes a framework for management of stormwater discharges.

The Urban Runoff Management, Comprehensive Control Program section of the Basin Plan requires dischargers to address existing water quality problems and prevent new problems associated with urban runoff through the development and implementation of a comprehensive control program focused on reducing current levels of pollutant loadings to storm drains to the maximum extent practicable. The SCVURPPP members are responsible for complying with Basin Plan requirements via the implementation of the SWMP.

Order No. 01-124 has been amended to include Provision C.3, concerning new and redevelopment performance standards to address post-construction impacts on stormwater quality. Provision C.3 calls for enhancement of the performance standard to increase the implementation effectiveness, primarily by:

- setting volume- and flow-based hydraulic sizing criteria for stormwater treatment measures;
- setting minimum sizes of new development and redevelopment projects which must employ the treatment measures;
- creation of a program to assure the adequate operation and maintenance occurs;
- creation of standards for source control measures and site design measures which can lead to reduced impervious surfaces for a given equivalent land use; and
- requires that the Dischargers develop a process and criteria to limit changes in the runoff hydrograph for new and redevelopment, where those changes could have a harmful effect on downstream beneficial uses.

For the reasons cited in Section 2, *Impacts*, the project should not be subject to requirements limiting changes in the runoff hydrograph; however, the EPA NPDES Phase II permit requires that stormwater runoff from a development site be treated to the Maximum Extent Practicable (MEP). In accordance with this requirement, a water quality analysis was performed to project water quality treatment needs associated with the proposed development

Detention ponds used for water quality treatment have been sized using a volume hydraulic design basis, which is the same for Extended Detention Basin or Constructed Wetland design. Section C.3. of the Phase 2 NPDES Permit requires that permittees implement BMPs that reduce pollutants in storm water to the technology-based standard of MEP. According to fact sheet TC-22 of the California Stormwater Best Management Practices Handbook (1993) (BMP Handbook), the MEP of treatment for these ponds is considered to be achieved with capture and infiltration of the 85th percentile annual runoff volume from the development area. The required treatment runoff volume is determined using the methodology of the BMP Handbook, using local rainfall data.

Following the BMP Handbook approach, the 85th percentile annual runoff is determined using a set of locally representative Capture Curves for a 48-hour drawdown period. The first steps in the approach are to select the appropriate capture curve and to calculate the composite runoff coefficient C for the development site. Next, a unit basin storage volume is read off the curve. Finally, the required BMP volume is calculated according to the equation:

BMP Volume = Unit Basin Storage Volume * Tributary Area

Based on the proposed land use and a weighted C-value of 0.8 for the proposed project, one or more treatment pond(s) would need to have a minimum capacity of 2.8 acre-ft. Capture Curves for the San Jose area were used for sizing the water quality ponds and were assumed to be appropriate for use in the Morgan Hill area. Table 8 shows the parameters used to estimate the required BMP volume.

Table 8 – Required Stormwater Treatment Volume

Required capture	Drawdown Period (hr)	Runoff C-value	Unit basin storage (in)	Tributary Area (acres)	Required Storage (ac-ft)
85th percentile of annual runoff volume	48	0.8	0.514	66.3	2.8

(5) Dual Purpose Detention and Water Quality Pond(s)

The detention ponds previously sized to mitigate for increased stormwater runoff from the proposed project could be constructed to meet both the City requirements for providing on-site storage for increased stormwater runoff and water quality treatment Stormwater detention ponds providing a minimum of 21.4 acre-ft. of storage with a minimum of 2.8 acre-ft for retention (dead storage) below the basin outlet works would provide sufficient volume to not only meet the detention pond sizing requirements of the City, including the requirement for 25% freeboard, but would also provide water quality benefits to satisfy NPDES Phase II Permit requirements that stormwater be treated to the maximum extent practicable, regardless of whether the C.3 provisions of Region 2 are deemed applicable to the project. Based on the proposed size of the detention ponds, the 2.8 acre-ft of retention storage would occupy approximately the bottom 2.3 feet of the ponds and could be drained over a period of 48 hours using a sump pump with an approximately 320 gpm capacity. With the exception of infiltration and/or evaporation, the sump pump would be the only way to drain the bottom 2.3 feet of the pond. The remainder of the pond would be drained using larger pumps as previously discussed in Section 3.a.1, Detention Facilities. Design standards and maintenance information for the recommended ponds are available in BMP Handbook Fact Sheets TC-21 – Constructed Wetlands, and TC-22 – Extended Detention Basin.

In the event of a second large storm event following closely behind the first storm, portions of the minimum storage required by City standards (21.4 acre-ft) would be taken up by any remaining retention storage provided for water quality (2.8 acre-ft) that had yet to be pumped out by the sump pump. This loss of storage capacity would be overcome by the 25% freeboard requirement built into the ponds per City standards.

The purpose of the 2.8 acre-ft of dead storage to be located at the bottom of the ponds is to allow sufficient volume to settle out sediments before discharging runoff from small storm events. The accumulation of sediments in the bottom of the ponds will decrease the amount of storage available for both detention and water quality treatment; therefore, maintenance provisions shall be adopted to clean out the ponds at a minimum whenever one (1) foot of sediment (measured by depth from the bottom of the ponds) has accumulated. In addition, the sump pump shall be equipped with an adequate intake to prevent sediment accumulation from effecting its performance.

Construction of dual purpose detention and water quality ponds would simultaneously reduce the impacts of increased stormwater runoff from the project site and potential water quality impacts associated with the project development to less than significant levels.